IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the application of:

Applicant: Vladimir Gorokhovsky
Serial No.: 09/847,353
Filed: May 3, 2001
Title: THERMAL FLUX REGULATOR
Our Ref: T8466103US2
Examiner: Not Known
Art Unit: 1763

VOLUNTARY AMENDMENT

To: The Commissioner of Patents and Trademarks
Washington, DC 20231
U.S.A.

Date: February 3, 2003

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2/6/03
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Please amend the above application as follows:

In the Abstract

Please rewrite the abstract to read as follows:

A1

A heat transfer regulating mixture having a metallic component A with a melting point T_A and a particulate ceramic component B which is non-wettable by the metallic component A, non-reactive therewith and which has a melting temperature T_B which is higher than both the temperature T_A and a desired operating temperature T_D which is also higher than T_A. The metallic component A and the particulate ceramic component B and the respective amounts will typically be selected to have a higher thermal resistivity below T_A than above T_A. The heat transfer regulating mixture may be incorporated in a thermal flux regulator having the mixture within an enclosure surrounding a heat generating reactor structure.

In the Disclosure

Please rewrite paragraphs [0045], [0046] and [0072] to read as follows:

Paragraph [0045]

In the instance of depositing a microcrystalline layer of diamonds on a particular substrate the selected substrate depositing temperature T_D is around 900°C. The substrate is in contact or is encased, except for the depositing surface, by a mixture of a metal or alloy having melting point between 200°C and 700°C, and ceramic particles, such as alumina, TiN, SiO_2 in the form of sand or quartz, or a mixture of these substances. Other ceramic particles which may be suitable as a component of the two-phase mixture of the present invention include boron nitride, boron carbide, silicon carbide, titanium carbide, high melting carbonitrides and oxynitrides, or chemical equivalents, and mixtures of such. The metal-ceramic particle mixture provides a semi-solid paste, or a highly viscous liquid bearing suspended solid particles, when in contact with the substrate at the temperature of the vapour deposition process, such as deposition of diamonds. When the heat is removed too fast, or the substrate temperature drops below the desired temperature, the two-component mixture freezes or solidifies, leading to poor or uneven contact between the mixture and the substrate. The effect on the heat removed, of the melting temperature of the lower melting component in the two-phase mixture in the neighbourhood of its melting point, is shown schematically in Fig.1a, where R_{TC} is the thermal contact resistance of the two component mixture, expressed as watts per cm^2 (w/cm^2), and T_A is the melting point of the lower melting component, usually a metal. It can be seen that the thermal resistance has a low value when the mixture in thermal contact with the substrate, is composed of a liquid metal and a suspension of ceramic particles, resulting in high heat flux. The high heat flux lowers the temperature of the substrate in contact with the mixture, leading to the freezing of the mixture, thus severing contact between the mixture and the substrate, thereby increasing the thermal resistance and lowering the value of heat flux, or the rate of heat transfer per unit area. Lower heat flux or lower rate of heat transfer from the substrate results in an increase in the substrate temperature, which in turn, leads to the remelting of the two-component mixture and to the restoration of heat removal rate to the previous level. Thus the heat flux from the substrate, and hence the

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substrate temperature (T_{st}), will oscillate around an average value T_P, between the depositing temperature T_D and the melting point T_A, of the metallic component of the two-phase mixture, as shown schematically in Fig.1b, and can be described by the inequality $T_A<T_P<T_D$.

Paragraph [0046]

A2 Cont

In the preferred embodiment of the invention, the substrate has a portion of its surface pre-treated to be able to receive the vapour deposited species. The pre-treatment usually includes mechanical and conventional cleaning process steps, and other known treatments to render the substrate surface receptive of the deposited species. The substrate is usually mounted in a substrate holder or mount, supported on a base or housing, which is immersed in an atmosphere containing the vapour to be deposited. As discussed above, the substrate is encased or is surrounded below the pre-treated portion of the surface, by a physical mixture of a low melting point metal or alloy and small sized particles of a ceramic material. The base supporting the substrate is usually made of metal, which represents the first stage of a conventional heat sink. Depending on the dimensions and on the nature of the base, the first stage of the heat sink has a certain thermal resistance, R_1. In the most simple case, the heat sink has only one stage, providing heat transfer between the substrate, the temperature of which is close to the melting temperature T_A of the lower melting component of the two-phase mixture, and the exit temperature T_L of the cooling liquid or fluid, circulating in the housing supporting substrate base. Thus $R_1 \sim (T_A - T_L)/Q$, where Q is the heat flux measured in watts per cm^2, ($w \cdot cm^{-2}$), and R_1 has dimensions $cm^2 \cdot {}^\circ C/w$. For example, when $Q = 100\ w \cdot cm^{-2}$, and (T_A-T_L) is 500°C, the value of the thermal resistance R_1 is close to $5 cm^2 \cdot {}^\circ C/w$.

Paragraph [0072]

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The moving species in a solid oxide electrolyte fuel cell is oxygen ions and in order to obtain sufficiently high current density the fuel cell is operated at temperatures close to 1000°C. The fuel cells are often designed for operating moving, electrically driven vehicles. For the most efficient utilization of the energy generated, as well as for the safety of the driver and the passengers, isolation